

# Editorial

## A Few Words From the Editor: On the Flourishing Use of Ultrasound in Brain Imaging and Therapy

LOOKING back at the history of medical ultrasonics, the 1950s has been a pivotal era of William and Francis Fry and their pioneering attempts to perform neurosurgeries using confocal four ultrasound transducer system. The Fry brothers demonstrated the feasibility of applying high-intensity (“intense”) focused ultrasound to treat patients suffering from Parkinson’s disease. The outcome of their experiments also indicated the critical need to develop tools to provide image guidance and subsequently spurred the development of brightness-mode (B-mode) ultrasound imaging that is widely used in today’s clinical practice. In the light of these seminal contributions, it is fair to say that early developments of ultrasound applications for the brain represent a major turning point in the medical ultrasound field that is now ubiquitous in both diagnostic and therapeutic applications.

I am delighted to note that the research and development bonding between ultrasound and the brain has remained strong and robust since the Fry brothers’ era. Novel ultrasound neuroimaging technologies and brain treatment protocols are actively being developed in laboratories around the world. As well, clinical translation efforts have been vibrant. One latest example is the clinical use of focused ultrasound to treat patients with Alzheimer’s disease. Multiple sites have recently demonstrated the feasibility of performing such treatment.

In the January 2021 edition of the UFFC TRANSACTIONS, we have published a Special Issue on “Recent Advances in Ultrasound Technology for Brain Imaging and Therapy.” This Special Issue marks our Journal’s celebration and acknowledgment of the central role that engineering advances play in researchers’ ongoing quest to apply ultrasound noninvasively to the brain. The Special Issue contains 19 original research articles covering a broad range of topics that include algorithm design, hardware development, and in-vivo applications in neuromodulation and neuroimaging. The elegantly presented article titled “Ultrasound for the Brain: A Review of Physical and Engineering Principles, and Clinical Applications” (*IEEE Trans. Ultrason., Ferroelec., Freq. Control*, vol. 68, no. 1, pp. 6–20, 2021) coauthored by the Special Issue Guest Editors provides a well-conceived helicopter overview on this important research topic in therapeutic medical ultrasound applications.

Since the publication of this Special Issue, UFFC TRANSACTIONS have accepted another original research paper on the topic and have received an update for one of the published articles. These two are published here in the February 2021 issue—the earliest available opportunity ensuring that the two articles remain closely linked in time to the original January 2021 Special Issue.

Let me briefly highlight these two articles: the new article by Qu *et al.* (pp. 341–351 of the February 2021 issue) presents an essential and innovative algorithmic contribution related to transcranial ultrasound systems. More specifically, it describes the technique of suppressing undesirable grating lobes that may arise when using transcranial array transducers. With the use of the authors’ algorithm, researchers may effectively reduce the risk of unintentional damage to brain tissues away from the treatment target due to the grating lobes.

An erratum update by Mozaffarzadeh *et al.* (pp. 352–353 of the February 2021 issue) clarifies the specific effects of head wave propagation on the phase aberration correction algorithm that is designed for transcranial ultrasound imaging. This update helps to strengthen the merit of the authors’ published Special Issue article (*IEEE Trans. Ultrason., Ferroelec., Freq. Control*, vol. 68, no. 1, pp. 84–91, 2021).

On behalf of the UFFC TRANSACTIONS, I express my deep gratitude to all authors who have contributed to the Special Issue on “Recent Advances in Ultrasound Technology for Brain Imaging and Therapy.” I also wish to offer my special thanks to the Special Issue Guest Editors—Weibao Qiu, Ayache Bouakaz, Elisa Konofagou, and Hairong Zheng—for their dedicated effort in putting together this important collection addressing the use of ultrasound in Brain Imaging and Therapy. I am convinced that research and development efforts on ultrasound applications for the brain will remain vibrant in the years to come. The UFFC TRANSACTIONS looks forward to publishing further reports on new technical solutions and innovative clinical translations on this topic in the future.

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